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ABSTRACT

This paper presents a reasoning taxonomy to explain reasoning objectives, strategies, and habits available to the advanced thinker. It begins by explaining the first part of the taxonomy, objectives of reasoning, including the need for skilled thinkers to reason with a purpose and to understand how the world works so that they can engage with it. Skilled thinkers use their knowledge and skills to make plans, to solve problems, and to communicate with others. They are able to make recommendations to others and provide reasons for them. The second part of the taxonomy, reasoning strategies, is then described. Reasoning strategies of gifted thinkers include the analysis and evaluation of ideas and arguments, the categorization and relating of items of knowledge, the movement from issue to questions to proposition, the consideration of evidence, and the employment of moral reasoning. The final section of the taxonomy, reasoning dispositions, posits that good reasoners value open-mindedness, objectivity, intellectual integrity, and impartiality and habitually practice metacognition. (Contains 43 references.) (CR)

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A Reasoning Taxonomy for Gifted Education

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In this paper I will present a reasoning taxonomy, that is, an overview of reasoning objectives, strategies and habits available to the advanced thinker.

A Reasoning Taxonomy

Section A- The Objectives of Reasoning

Section B - Reasoning Strategies
1. Community of Inquiry
2. Model construction
3. Argument construction
4. Considering the Evidence
5. Moral reasoning.

Section C - Reasoning Dispositions.

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As a lecturer in Gifted Education with a specialisation in Reasoning, I perceive a need for such a taxonomy. Numerous classroom texts containing thinking strategies abound, but it is rarely easy to discern with confidence what aspects of thinking are being targeted by particular exercises found in these texts. Without being sure of what they are trying to achieve, it is difficult to match them to the needs of students. Before I offer a means of doing so, however, let me place this exercise in the context of what we understand giftedness to be.

Jewell

A considerable number of researchers believe that intelligence and (perhaps by implication) giftedness, has a biological foundation. Clark (1992, p.8), for example, says, "Giftedness is a biologically rooted concept that serves as a label for a high level of intelligence and indicates an advanced and accelerated development of functions within the brain..."

The obvious alternative candidate to the biological explanation is that gifted behaviour is learnt behaviour, that skills, competences, strategies and techniques can be acquired, cultivated and practised.

I will not rehearse yet again the well worn arguments of the nature/nurture debate. Nor do I think, "Well, it is both," is a satisfactory resolution of the debate unless the respective roles of nature and nurture are usefully articulated.

I will however, make the following fairly obvious claim. Either giftedness is entirely acquired, or it is acquired on a biological base. Either way, it is acquired. Perhaps a useful, measurable biological explanation of giftedness will one day eventuate. Perhaps not. There is no doubt, however,

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that giftedness manifests as learnt behaviour. Nobody is born exhibiting gifted behaviour, whatever the potential might be.

Debate continues over what behaviours should count as gifted. Two strong contenders for recognition are creative thinking and logical/rational/critical thinking. At the 1994 Conference on Thinking, Matthew Lipman proposed a third candidate for recognition, that of interpersonal skills and moral behaviour. My colleague, Maria McCann, has usefully dubbed our contemporary investigations as the three C's - Creative thinking, Critical thinking and Caring thinking. Whilst much of the remainder of this paper can be seen as focusing on the centre piece of this trinity, i.e., critical thinking, it will become apparent that the three contenders for recognition are far from mutually exclusive. Humans can, indeed, humans typically do, use creative techniques to aid the logical solution of problems and critical thinking in order to respect and care for fellow humans. Of all the species on this planet, humans alone are creative, humans alone are logical and only humans have developed moral systems. It is not surprising that there is considerable integration of these performances in humans, rather than discrete divisions Thus creative thinking, critical thinking and caring thinking can usefully be seen as complementary aspects of rational human behaviour.

I maintain that the quintessential feature of humans is that they try to figure out what makes the world tick so they can fiddle with it to advantage. This claim fits exactly with Ennis' definition of critical thinking, that is "reasonable reflective thinking on what to believe and do" (Ennis, 1985 in Bernstein 1990 p79).

How can people reflect on what to believe and do? What strategies are available to people who wish to develop competence in figuring out what makes the world tick? What advantages might there be in listing these strategies?

I will deal with this last question first. Being aware of the strategies enables us to foster them as well as empathise with and understand people who are using them. To draw an analogy, knowing the structure of music will help if we are dealing with a musically gifted child even if we are not gifted ourselves. Knowing the structure of reasoning is of similar service.

Further, I hope that by listing reasoning strategies, aims and attitudes, by providing a Reasoning Taxonomy, I can ameliorate some current confusion. The confusion arises because a number of disciplines have an interest in these areas known variously as critical thinking, clear thinking, logical thinking, critical reasoning, as well as creative thinking, caring thinking and moral reasoning. From Philosophy we get logic, epistemology and ethics. From Psychology comes cognitive science. From English comes clear expression. Howard Gardner (1985), reviewing just the discipline of Cognitive Science, wrote of the contributions of Philosophy, Psychology, Artificial Intelligence, Linguistics, Anthropology and Neuroscience to that

area alone.

My own discipline is Philosophy, which has certainly been working away in this area the longest. Plato was interested in giftedness, believing that it was a function of biology and training (Ebenstein 1990).

The reasoning taxonomy that I herewith present is drawn then largely from a Philosophical perspective. Because Philosophy has a long running interest in reasoning, not only within its own domain but across the disciplines (Paul 1993), I trust that this taxonomy will provide a foundation for our understanding of advanced reasoning techniques and at the same time a scheme to which we can refer whilst dealing with the myriad terms and approaches of all the different disciplines, plus the varying approaches of texts which deal directly with thinking.

To illustrate, one such text "Catch Them Thinking - a Handbook of Classroom Strategies" by James Bellanca and Robin Fogarty (1993) make distinctions between critical thinking, creative thinking and problem solving. Under critical thinking they have a Venn Diagram Chapter, extracts of which follow.

> Thinking Skill: Comparing and Contrasting
>
> Focus Activity:
> Review with the students the word attribute. Provide other synonyms and ask students to explain the five S's (sense, sound, smell, size, and speciality).
>
> Show them two similar objects in the classroom, and ask them to list in their LOGs how the objects are similar (e.g., your desk and the students desk).
>
> Ask students to list characteristics that are not similar in the objects
>
> Input: ... show them how to use a visual format, the Venn diagram, to help in the identification of similar and different characteristics
>
> Metacognitive discussion ... highlight the subtle and/or obvious similarities and/or differences.

What sort of thinking activity is being promoted here? Bellanca and Fogarty list it as Critical Thinking. Certainly Venn diagrams are used by logicians to demonstrate formal validity, which therefore fits the category of reasoning / critical thinking. But Bellanca and Fogarty are using it as "one of the most practical tools for helping students visually differentiate characteristics" and to "compare and contrast" (p 101). Further, the metacognitive discussion is reminiscent of creative thinking via making associations.

The distinction between critical thinking and creating thinking is found in other texts, such as Reid's "Thinking Skills Resource Book (1990), but Reid lists associative thinking as creative, though labelling and observation come under critical thinking, as does deductive reasoning. In a companion publication to Bellanca and Fogarty's "Catch Them Thinking", Berman (1993), in "Catch Them Thinking in Science" has labelling as information gathering, as distinct from information processing. According to Berman, information processing includes noting attributes and critical thinking, in contrast to Parks and Black, who in their text "Organising Thinking" put critical reasoning in language arts and do not mention it in science.

Confusion increase as the vocabulary multiplies. David Perkins (Perkins, D. N., Goodrich, H., Tishman, S. & Owen, J. M., (1994) (1994) talks of mental management and understanding through design. Perkin's co-author, Tishman (1996) is interested in thinking dispositions. O'Tuel and Bullard (1993) discuss higher order thinking. I have myself so far in this paper used synonymously the terms reasoning, critical reasoning and critical thinking.

To ameliorate this confusion, some selectivity is necessary. If there are different types of thinking, focussing on one type at a time may promote lucidity. Reasoning is a type of thinking. It is purposeful thinking. It orders information in order to produce a result. It provides reasons for adopting a belief or course of action.

Texts that offer to promote thinking skills can be evaluated against this criterion. Does the text seek to promote reasoning, or some other thinking skill? If reasoning, what objectives, strategies or dispositions does it promote, and how well does it do so?

A taxonomy of reasoning will facilitate such an evaluation of classroom texts and practices. I have to admit that providing such a scheme runs the risk of just adding to the confusion, but I fervently hope that does not eventuate.

A Reasoning Taxonomy

The taxonomy can usefully be divided into three fields - objectives, strategies and dispositions, as follows.

A - Objectives of Reasoning
B - Reasoning Strategies
C - Reasoning Dispositions / Attitudes / Habits.

In Section A, the Objectives of Reasoning include to learn, to make decisions, to produce results.

In Section B, the Reasoning Strategies include debate, analysis, seeking reasons and evidence for and against propositions, and making judgements about best courses of action.

In Section C , the Dispositions include the desire to be reasonable, the habit of self monitoring, the readiness to seek and provide justification for decisions.

There follows a brief description of the items in each section, then subsequently, further elaboration.

Section A- The Objectives of Reasoning

Skilled thinkers reason with a purpose. They seek to understand how the world works so that they can engage with it. They seek out information relevant to that purpose. They use their knowledge and skills to make plans, to solve problems, and to communicate with others. They are able to make recommendations to others, providing reasons for that recommendation.

Section B - Reasoning Strategies

Skilled thinkers can develop a number of reasoning techniques, which they can employ as appropriate.

1. Community of Inquiry

Critical thinking involves the analysis and evaluation of ideas and arguments. The words "critical" and "argument" have negative connotations, being associated with dispute and personal conflict. In sharp contrast to those negative connotations, skilled reasoners exchange and debate ideas in a productive manner. Rather than attempting to score points in adversarial debate, they collectively seek the truth. They fearlessly examine the merits of ideas, whilst treating with respect and sensitivity the persons who propose them.

2. Model construction

Skilled reasoners categorise and relate items of knowledge. They attempt to make sense of the world. They construct mental pictures or models which they can manipulate in meaningful ways. They identify each others' models and exchange models productively.

3. Argument construction

Skilled reasoners move from issue to question to proposition. They examine an issue and develop significant questions from that issue. They propose possible answers to those questions, and then argue the merits of those propositions, seeking reasons to accept or reject the proposed answers. They aim to construct valid arguments and avoid fallacies.

4. Considering the Evidence

There is a difference between unsubstantiated opinion, and judgements based

on evidence and observation. Skilled reasoners make this distinction as appropriate. They abstract general principles from observation, using inductive reasoning, but are aware of the fault of overgeneralising. They gather evidence to justify their beliefs, but also actively seek out evidence which could challenge them.

5. Moral reasoning.

Since reasoning is considering both what to think and what to do, it involves making value judgements about the best course of action. For a reasoner, value judgements are not whimsical or idiosyncratic, but conform to a coherent value system.

Section C - Reasoning Dispositions.

As well as techniques, good reasoners have attitudes, disposition and habits. They value open-mindedness, objectivity, intellectual integrity and impartiality. They habitually practise metacognition, that is, they think about their thinking processes.

Expanding the Reasoning Taxonomy

Space does not permit an exhaustive description of the details of this taxonomy, but I will expand somewhat on its various components.

Section A- The Objectives of Reasoning

To discover how things work in order:

1. To plan
2. To problem solve
3. To decide
4. To recommend
5. To communicate

Rational people wish to discover how things work so that they can plan for the future, and solve problems. This is to my mind the essence of creative thinking, too. To be creative is to view a state of affairs as it is, to envisage (imagine) a different (preferable) state of affairs, and to take action to bring about that envisaged state. The new state might be a result of putting oils on canvas, of words on a page, or a satisfactory resolution of a scientific problem.

Since people are by nature and necessity gregarious, both learning about the world and changing it requires the communication of preferences, ideas and recommendations between people, including reasons to support recommendations. The act of reasoning may be performed solitarily, but it typically takes place in the context of discussion.

Reasoning people exhibit the quintessentially human characteristics of

wanting to know about how the world works, being able to imagine different and better states of affairs, communicating with others, solving problems and thereby producing results valued by themselves and others.

In order to do this, productive people engage in the activity variously termed reasoning, critical reasoning, or critical thinking.

As mentioned above, Ennis proposed what has become a widely accepted definition of critical thinking: "Critical Thinking is reasonable reflective thinking on what to believe and do."

Scholars at the 1993 XIth International Conference on Thinking, USA proposed the following description of a critical thinker.

A well-cultivated critical thinker:

* raises vital questions and problems, formulating them clearly and precisely;
* gathers and assesses relevant information using abstractions to interpret it effectively;
* comes to well-reasoned conclusions and solutions, testing them against relevant criteria and standards;
* thinks open-mindedly within alternative systems of thought, recognising and assessing, as need be, their assumptions, implications, and practical consequences; and
* communicates effectively with others in figuring out solutions to complex problems.

Critical thinking is, in short, self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and mindful command of their use. It enables effective communication and problem-solving abilities.

Section B - Reasoning Strategies

1. The Community of Inquiry

Discussion between people is not always reasonable. It can sometimes be conflictful, or simply expressive of feelings. It may have aims other than critical reasoning. A code of behaviour has been developed for people who wish to engage in an exchange of views as a reasoning process. This code is known as the code of the Community of Inquiry, and my description of it is as follows.

Code of the community of inquiry.

1. When you are presenting your ideas to other people, have the intention of seeking help in discovering any weaknesses, errors or potential improvements, and be grateful when they are pointed out.

2. If you are listening to other people's ideas, interpret them in the best possible light. Do not nit-pick or trivially criticise.

3. Examine the merits of ideas, not the people who present them. Do not defend someone's ideas because he is your friend. Do not attack someone's ideas because she is your enemy. Do not take an attack on your ideas as an attack on yourself.

4. Explore the strengths and weaknesses of a variety of ideas, without regard to how you personally value them, or how popular/unpopular they may be. Defend ideas that you disagree with, as well as those you agree with. For the sake of logical discussion, dispute positions that you agree with, as well as those you disagree with. When someone else presents a position, do not assume that s/he personally agrees with or values that position.

5. Remember that Critical Thinking is not about "beating the other person in an argument" or about "effectively defending your own personal opinions". It is about collectively and cooperatively arriving at the truth.

Note that this code, while central to the practice of critical thinking, deliberately promotes creative thinking and caring thinking. It encourages thinkers to imagine possibilities, to formulate ideas and to exchange them fruitfully with others. It encourages respect and regard for other people's sensitivities and discourages adversarial tactics. It favours openness, communication and reasonableness whilst ruling out bullying and point-scoring. The community of inquiry is as much an attitude and an approach as it is the behaviour of a group. (Lipman, 1991)

2. Model construction

When people reason about the world, fitting their experiences into explanatory structures, they are building models of the universe. In their minds they can play with these models, manipulate them, speculate with them, imagine fanciful or practical outcomes.

For illustration of simple model construction, I may wonder whether the new wardrobe I am contemplating buying will fit into my bedroom. I could, of course, just buy the wardrobe and see if it fitted, though this would not be an intelligent or reasoning approach to the problem. I could make a cardboard scale model of the wardrobe and the bedroom. If my model wardrobe fitted into my model bedroom, I would have reason to believe that the real wardrobe would fit into the real bedroom. (This assumes, of course, that the model wardrobe and bedroom relate to each other in the same way the real ones do.) I could even simply measure the wardrobe and bedroom and use numbers to represent them in my mental model. Again, if the relationships of

the elements in my mental model are the same as the relationships of elements in the real world, then I can run my mental model and get a conclusion (say that the wardrobe won't fit) and expect to get that same conclusion in the real world (Jewell 91).

There are economic models, political models, models in science, indeed in every field of learning. Models may contain values (e.g. the sanctity of life) metaphysical entities (God, for example), notions of human nature and so on.

A model, then (or a paradigm, or a world view, or a belief set) is a set of assumptions that tells you what sorts of things exist in the universe, how they are related to each other and how they relate to the problem at hand.

One model can provide analogous structures for the construction of others. The analogy of "motherland" moves from a family model to a national one. Analogous reasoning demonstrates how interlinked is the trinity of creative thinking, critical thinking and caring thinking. The construction of interesting and productive analogies is a creative act. It is creative both in the sense of making connections between disparate ideas (Torrance, 1988; Mednick, 1962) and in the sense of considering a current state of affairs and envisaging a new one. Thus it is both creative thinking and critical thinking. Further, a significant part of caring is empathy. To be empathetic is to see issues from another's point of view, to understand how one would feel in an analogous position. I maintain, therefore that the greatest analogy, in the sense of the most complex and the most worthy analogous thinking, is empathy.

Frequently, a model within which one is reasoning proves inadequate. For example, a biological model of illness may exclude psychological factors. An economic model of social progress may pass over subjective quality of life. The ability to see beyond the constraints of an inadequate model is a productive and creative skill. Whether this act is understood as model exchange (Jewell, 89), paradigm shifting (Kuhn, 1970; Chalmers, 1982; Appleton, 1993) or lateral thinking (De Bono, 1990), it is an essential tool in creative thinking, critical thinking and caring thinking.

3. Argument Construction

There are numerous texts on reasoning that are devoted to argument construction and their contents best speak for themselves, rather than be reviewed here. Some of these texts admittedly are overly concerned with identification of fallacies in other people's arguments, rather than the autonomous construction of good ones.

The process of argument construction begins with the identification of an issue, for example, the needs of gifted students. This can evolve into a question, for example, are gifted students' needs met adequately by the standard curriculum? This question can evolve further into an arguable proposition, for example that acceleration is the best way to meet gifted

students needs. Argument for and against acceleration can then be considered, including the identification of premises, hidden premises, conclusions, valid and invalid forms of reasoning.

Formal study of arguments can involve syllogisms, symbolic logic, truth tables and connectives (Black, 1952; Copi, 1961; Cedeblom & Paulsen, 1986; Kelley, 1988; Moore & Parker, 1989; Barry & Rudinow, 1990; Fogelin & Sinnott-Armstrong, 1991; Kiersky & Caste, 1995).

4. Considering the Evidence.

We all cherish our own opinions, whether they be expression of what we value, or descriptions of how we believe the world to be. Skilled thinkers make the distinction between the intention to express values and the intention to describe facts. If it is facts that are being dealt with, they seek to justify beliefs of fact by examination of evidence - the more evidence the better. Not content with merely gathering evidence to verify their opinions, they actively seek out evidence that would falsify it, and happily change their views in the light of such evidence. They understand the worth of evidence based on reliable, numerous and varied observations rather than single cases or unsubstantiated anecdotes (Ayer, 1971; Lipman, 1982; Giere, R. N., 1991; Popper, 1960 ; Cohen, 1989).

5. Moral Reasoning.

To some people 'moral reasoning' is an odd term. Morals are what you have, they are a matter for individual conscience, rather than a matter for reasoning like science or logic. Human beings, though, make decisions and many of these decisions are moral ones, involving judgements about the best thing to do. Reasonable people seek reasons to direct and justify their decisions.

There are several strategies to choose from when reasoning about moral decisions. One is to be sensitive to the value system of one's social group, to be aware of the expectations others have, and the social contracts, overt or tacit that exist between kinsfolk, friends or wider social arrangements.

Reasoners will not however, unquestioningly accept social expectations, but will measure them against some criterion of justification. Two criteria are commonly used. One is the consideration of the consequences of one's moral decision. This strategy considers which is the most useful and effective action in promoting people's happiness and minimising distress.

Another is the strategy of applying moral principles. Such principles should be universally applicable, and should acknowledge people's rights and their duties. Typical principles prohibit lying or making insincere promises (Rosen, 1993; White, 1988; Jones, 1975; Cam, 1993; Bentham, 1823; Mill, 1971).

Section C - Reasoning Dispositions

Metacognition is thinking about one's own thinking. The disposition to adopt metacognition as a habit turns a mere knowledge of reasoning strategies into productive practice. Reasoners question their own positions and opinions, seeking and offering justification for their views. They are willing to construct or adopt alternative models, to monitor their own assumptions and thinking habits, and change their minds for good reasons. They practise empathising with the beliefs, values and thinking processes of other people (Tishman & Andrade,1996; Nickerson,1985).

Conclusion.

I trust that in presenting this Reasoning Taxonomy, I have assisted my colleagues in Gifted Education in a number of ways. I hope I have provided a fairly comprehensive picture of what it means to be an exceptionally competent reasoner. I hope that this picture can serve as a point of reference for the judgements of educational texts and practices which are intended to develop reasoning skills and practices. I believe I have indicated the intertwining of the trinity comprising Creative thinking, Critical Thinking, Caring Thinking. Lastly, I hope I have crystallised a view of reasoning which is constructive, productive, methodical, ethical and empathetic.

A Reasoning Taxonomy

Section A- The Objectives of Reasoning
To discover how things work in order:
1. To plan
2. To problem solve
3. To decide
4. To recommend
5. To communicate

Section B - Reasoning Strategies
1. Community of Inquiry
2. Model construction
3. Argument construction
4. Considering the Evidence
5. Moral reasoning.

Section C - Reasoning Dispositions.
Metacognition
The disposition to:
1. question own position
2. seek and offer justification for views
3. adopt alternative models
4. empathise with the beliefs, values and thinking processes of other people

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